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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/809,451	03/26/2004	Tetsuro Mizushima	119237	7669
25944 7590 01/24/2008 OLIFF & BERRIDGE, PLC P.O. BOX 320850 ALEXANDRIA, VA 22320-4850			EXAMINER VERDERAME, ANNA L	
			ART UNIT 1795	PAPER NUMBER
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Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary	Application No. 10/809,451	Applicant(s) MIZUSHIMA, TETSURO	
	Examiner Anna L. Verderame	Art Unit 1795	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 07 December 2007.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 13, 15 and 24 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 13, 15 and 24 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 11 June 2007 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.
 Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
 Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☒ All b) ☐ Some * c) ☐ None of:
1. ☒ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. _____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- | | |
|--|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413) |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | Paper No(s)/Mail Date. _____ |
| 3) <input type="checkbox"/> Information Disclosure Statement(s) (PTO/SB/08) | 5) <input type="checkbox"/> Notice of Informal Patent Application |
| Paper No(s)/Mail Date _____ | 6) <input type="checkbox"/> Other: _____ |

DETAILED ACTION

In view of the applicant's amendments all of the previously presented rejections are withdrawn. New rejections are presented below for the presently pending claims.

Claim Rejections - 35 USC § 103

1. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

2. Claims 13 and 15 are rejected under 35 U.S.C. 103(a) as being unpatentable over Kasai et al. 4,214,249 in view of Slinger et. al. "photodoped chalcogenides as potential infrared holographic media", Applied Optics Vol 31(14) pp.2490-2498 (05/1992) and King et al. 6,721,076.

In example 2 Kasai et al. an optical recording medium comprising a metal dispersed chalcogenide recording material. Silver was used as a diffusible metal and an Ag layer of about 20 nm was formed on the Ge₂S₃ recording film which had been formed on a polyester sheet. A blanket light irradiation was applied to the Ag+Ge₂S₃ bi-layer to diffuse the Ag of the diffusible metal layer completely and mutually into the Ge₂S₃ layer so that an Ag-Ge-S chalcogenide glass was prepared. An image recording was carried out with respect to the chalcogenide glass recording member by using an argon laser(output 200 mW, wavelength of 488nm)(13/11). In addition, copper was employed as a diffusible metal in place of Ag as mentioned above and vacuum-

deposited on the Ge_2S_3 film in a similar manner and blanket light irradiation was applied thereto to prepare a Cu-Ge-S chalcogenide glass(13/55-14/26). Chalcogenides listed in the table at (13/45-50) were also used.

Kasai teaches the use of other chalcogens such as As-S, Ge-S, As-S-Ge, Ge-Se, and others. The reactivity of chalcogen elements is similar to each other so that the various chalcogenides obtained by modifying the above exemplified chalcogenides by changing the chalcogen elements can be effectively used (5/25-49). It is also effective to incorporate to the non-metallic (chalcogenide) layer, a minor amount of metal as an additive for the purpose of improving light sensitivity and the optical density.

Representative metal additives may be Ag, Cu, Cd, Mn, Ga, In, Bi, Sb, Fe, Ni and alloys thereof. Ag and Cu are most preferable. The amount of the metal additive may be 1-0.0001 atoms per 100 atoms constituting the non-metallic (chalcogenide) layer. Usually, 0.5-0.005 atoms per 100 atoms are preferable (5/62-6/2).

In regard to the limitation in claim 1 that the content of the metal particle is at least 0.1 vol % and less than 2 vol%, it is held that the teachings of Kasai meets these limitations for the following reasons(which were discussed in the June 6 interview): Kasai teaches 0.0001-1 metal atoms per 100 atoms of chalcogenide and more preferably 0.5-0.005 metal atoms per 100 atoms of chalcogenide.

Ag^+ -1.26 angstroms

S^{2-} -1.84 angstroms

Ge^{2-} -2.57 angstroms

GeS-2.57 angstroms

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This is approximately a 2:1 ratio (volume of GeS:volume or Ag⁺).

Example: A film formed according to the teachings of Kasai having one silver atom per 100 atoms of GeS yields a film having 0.49 vol% Ag. This is within the range of 0.1 vol % and 2 vol % recited in claim 1.

In regard to the limitation that the metal particles have a particle size of less than 35 nm, it is held that the teachings of Kasai meet these limitations for the following reasons:

Ag⁺- radius of 1.26 angstroms=0.126 nm

A particle having a size of 35nm can contain 277.7 silver ions.

Based on this it is held that the particles dispersed in the chalcogenide glass will have a particle size of 35 nm or less.

In regard to the limitation of claim 21 that the particle size be "no greater than 20 nm" it is held that the teachings of Kasai meet this limitation for the following reasons: a particle having a size of 20 nm contains 158.7 silver ions(atoms). Based on this it is held that the particles dispersed in the chalcogenide glass will have a particles size of 20 nm or less.

Note particle size is interpreted to the radius of the particle.

In regard to the limitation in claim one that "the metal particles be dispersed in the glass prior to a process of recording material by irradiation of light", the examiner refers to example 2 of Kasai et al. The step where a blanket light irradiation was applied to the Ag+Ge₂S₃ vacuum-deposited film as shown in Fig 5. by means of a xenon lamp to diffuse the Ag of the diffusible metal layer completely and mutually into

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the Ge_2S_3 so that an Ag-Ge-S chalcogenide glass was prepared(13/61-67), is separate and distinct from the step of image recording with respect to the thus formed chalcogenide glass (14/1-16). Therefore, it is held that the chalcogenide glass containing dispersed metal particles is formed before the recording step. See also figures 5-6. As further evidence for two separate steps, note different light sources used. Xenon lamp used for formation of Ag-Ge-S glass, and Argon laser(488 nm($1/20\lambda \approx 24$ nm)) used for recording (14/3 and 13/10-11).

Kasai teaches use of a short wavelength such as from an Argon laser (488nm) for writing and the use of a long wavelength such as from a He-Ne laser (630 nm) for reading (reproducing) the data(7/20-30).

Kasai et al. does not explicitly teach a method of hologram recording.

Slinger et al. teaches that an amorphous chalcogenide layer is deposited by spin coating on to a substrate. A thin metal film is deposited on top of the chalcogenide. Light of a suitable wavelength is arranged to form an intensity pattern in the chalcogenide, corresponding to the profile of the desired grating. Initially, the actinic radiation is absorbed at the chalcogenide glass-metal interface. This causes growth of metal-doped regions into the chalcogenide. Subsequently, incoming radiation probably absorbed at the undoped-doped glass boundary, causes further growth of the doped region with a corresponding depletion of the metal reservoir. The silver concentration is uniform throughout the photodoped region. It is important to note that migration of the metal is only along the direction of incoming radiation(page 2491). The chalcogenides used in this paper were arsenic sulfides ($\text{As}_x\text{S}_{1-x}$, where $0 < x < 1$ and x is usually .4) with

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silver as the doping metal, although other chalcogenides and metals are known to exhibit the same effect. The actinic radiation can be anywhere from x-rays through beyond visible red wavelengths. The choice depends on the chalcogenide-metal system and the thickness of the chalcogenide film(pp.2491-2492 grating formation). The photodissolution effect in chalcogenides shows promise as one of the few techniques for producing low-loss holographic materials for use at any given wavelength 600 to beyond 1600nm(abstract). Figure 2. shows the transmittance of the doped and undoped As_2S_3 film. In regard to claim 15, the short wavelength end of the transmitting region for the chalcogenide glass is around 500 nm. This figure also shows the large difference in transmission between the doped and undoped material. Figure 3. shows the dependence of the refractive index of the doped and undoped films on the wavelength of light.

Several bulk gratings(both thin and volume types) have been made using holographic exposures. Recordings were made by using the interference of two plane waves from a single frequency argon ion laser operating at 514.5 nm(page 2495 top of column 1). This disclosure teaches a two beam process in which the wavelength of each of the two beams is equal to $\frac{1}{2}$ of the corresponding optical energy gap of the chalcogenide.

King et al. teaches that when recording a volume hologram, a large number of holograms can be stored in the same volume using multiplexing techniques. There are several techniques for multiplexing holograms including shift multiplexing, angle multiplexing, wavelength multiplexing, correlation multiplexing, and phase

multiplexing(1/33-40). Angle multiplexing involves storage of multiple pages of data in the same photorecording medium by altering the angle of the reference beam entering the media during the storage of each page while maintaining the position of the object beam(signal beam)(2/38-58).

King et al. does not teach the use of holographic recording in photodoped chalcogenides. However, this is taught by Slinger and specific holographic recording methods including angle multiplexing can be employed in any material capable of being recorded using holographic recording in general.

A hologram recording method which employs two beams which include a signal beam and a reference beam is well known in the art in general and is taught above by both Slinger et al. and King et al..

It would have been obvious to one of ordinary skill in the art to use the photodoped chalcogenide film, formed by the application of blanket irradiation to an Ag+ Ge₂S₃ bilayer to diffuse the Ag of the diffusible metal layer completely and mutually into the Ge₂S₃ layer so that an Ag-Ge-S chalcogenide glass was prepared, taught by Kasai et al. and to record the photodoped chalcogenide film using a hologram recording step in which the recording light is composed of a signal and a reference beam based on the holographic recording methods on similar photodoped chalcogenides by Slinger et al.. Further, it would have been obvious to employ a holographic recording method wherein the angle of the reference beam is varied, such as an angle multiplexing method like that taught by King et al., in order to obtain the benefit taught by King et al. of being able to form a large number of holograms in the same volume.

3. Claim 24 rejected under 35 U.S.C. 103(a) as being unpatentable over Slinger et al. "photodoped chalcogenides as potential infrared holographic media", Applied Optics Vol 31(14) pp.2490-2498 (05/1992) and Hosono et al. JP-2001-236002(machine translation provided).

Slinger et al. teaches formation of volume(depth, length, and width) and surface holograms but does not explicitly teach varying the recording light in the direction of the depth of the recording layer in the recording step.

Hosono et al. teaches a hologram recording method in which two-beam laser interference exposure method is used to irreversibly record in a transparent material semi conductor material or metal material(abstract). Formation of holograms in a hologram recording step by varying the incidence location of the two beams in the depth direction is taught at(0018). See also (0041).

It would have been obvious to one of ordinary skill in the art to use the photodoped chalcogenide film, formed by the application of blanket irradiation to an Ag+ Ge₂S₃ bilayer to diffuse the Ag of the diffusible metal layer completely and mutually into the Ge₂S₃ layer so that an Ag-Ge-S chalcogenide glass was prepared, taught by Kasai et al. and to record the photodoped chalcogenide film using a hologram recording step in which the recording light is composed of a signal and a reference beam based on the holographic recording methods on similar photodoped chalcogenides by Slinger et al.. Further, it would have been obvious to employ a holographic recording method

wherein the recording light is varied in the direction of the depth of the recording layer as taught by Hosono in order to achieve volume holograms.

Conclusion

Response to Arguments

4. The examiner notes that support for the amendments are actually found at (0043) and (0013) in the specification. Further figure 31, argued by the applicant not to be in Kasai et al, is found in Inoue '317 cited in the office action mailed on 02/09/2007.

5. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure.

-Wilson et al. 6,798,547-process for holographic multiplexing

-Meneghini et al. As₂S₃ photosensitivity by two-photon absorption:holographic gratings and self-written channel waveguides- See summary section 4.

-Pastor et al. 6,710,901- (3/45-60)

6. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Anna L. Verderame whose telephone number is (571)272-6420. The examiner can normally be reached on M-F 8A-4:30P.

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If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Mark Huff can be reached on (571)272-1385. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

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